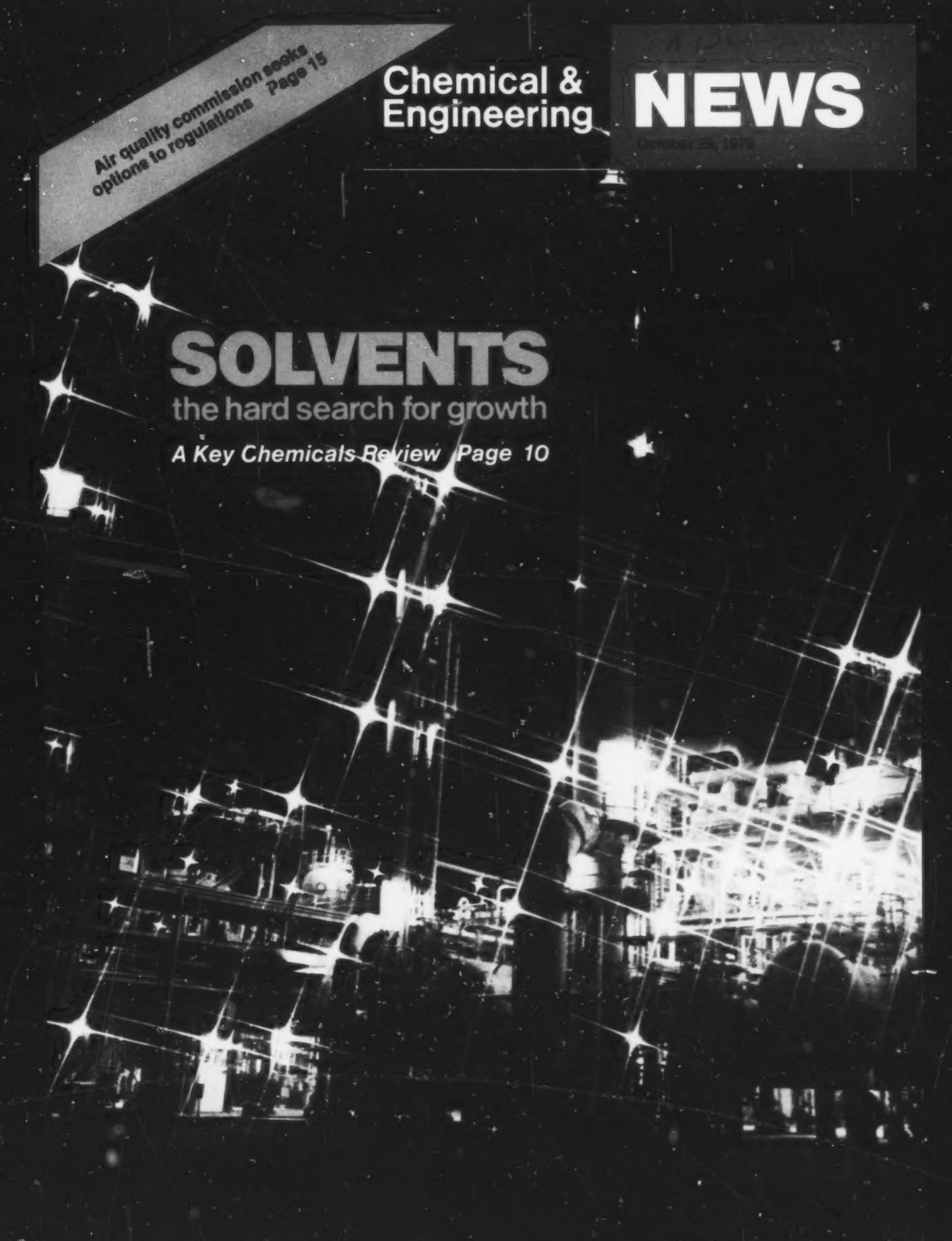
Chemical & Engineering NEWS
October 28, 1979

Air quality commission seeks options to regulations Page 15



SOLVENTS

the hard search for growth

A Key Chemicals Review Page 10

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Chemical & Engineering NEWS

Cover: PPG Industries' 1,1,1-trichloroethane solvent plant at Lake Charles, La., which came on stream early this year

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News of the Week

- ***Third-quarter chemical earnings*** *of major oil companies have risen even faster than their earnings from all operations.* ***Page 6***
- ***No apparent excess deaths from dioxin*** *exposure is conclusion of mortality study of Monsanto workers accidentally exposed to chemical 30 years ago.* ***Page 7***
- ***An experimental electroplating method*** *that uses a laser to enhance metal deposition over small areas has been developed by scientists at IBM.* ***Page 7***
- ***Analytical instrument show,*** *Expochem 79, was held in Houston last week—the first time in the Sunbelt for a major analytical conference.* ***Page 7***
- ***Hybrid polyethylene*** *called linear low-density polyethylene made via low-pressure process has been disclosed by Dow.* ***Page 8***
- ***Toxic chemical contamination cases*** *involving two companies—Hooker Chemicals & Plastics and Velsicol Chemical—have been settled out of court.* ***Page 8***

Business

- ***Ethanol and 1,1,1-trichloroethane,*** *key solvents, reflect 1979 downturn, with demand slow, production expansion and use growth stalled.* ***Page 10***

Government

- ***Alternatives to present air quality rules*** *and five regions for testing them will be studied by special commission, which will suggest changes to Congress.* ***Page 15***
- ***Symposium on innovation*** *discloses MIT's concept of government's role—it should stand aside so that only the fittest companies survive.* ***Page 17***

Science

- ***Relations between academic and industrial chemists,*** *beset by differing priorities, comprised the agenda of a conference at Dow, which aired problems, especially money, considered solutions.* ***Page 20***
- ***Antiprotons among cosmic rays*** *have been observed for the first time outside a laboratory, in an experiment aboard a balloon over the Southwest.* ***Page 22***
- ***A new moon of Jupiter,*** *the fourteenth, has been detected in pictures taken July 8 by Voyager 2; moon could be fastest-moving satellite in solar system.* ***Page 22***

Technology

- ***Sewage-treatment system*** *(Thetford's Cycle-Let) holds big promise: cuts freshwater use up to 90%, cleans wastewater enough for utility uses, eliminates need for septic tanks and sewers.* ***Page 25***

ACS News

- ***Updated edition of the safety manual,*** *"Safety in Academic Chemistry Laboratories," is being offered by ACS.* ***Page 27***
- ***Official reports*** *of committees of the ACS Board of Directors and Council from the Washington national meeting.* ***Page 28***

PETROCHEMICAL PROFITS SOAR IN THIRD QUARTER

Although the huge increases in oil companies' third-quarter profits have been gaining headlines lately, little noticed is that chemical earnings among these companies have grown even more rapidly than their earnings from all operations.

For five oil companies that released their third-quarter reports last week—Exxon, Gulf, Standard Oil (Indiana), Mobil, and Conoco—combined earnings from their chemical operations totaled $299.5 million for the third quarter. This is an average increase of 126.9% from the $132 million that their chemical operations posted in the third quarter of 1978. At the same time, combined third-quarter earnings from all operations of the five companies totaled $2.9 billion, an increase of 88.6% over last year's third quarter.

The same situation holds true for the first nine months of this year. During that time, profits of the five oil companies combined increased 39.7% to $7.5 billion. However, earnings from chemical operations shot up 116.8% to $839.6 million for the first three quarters of 1979.

The improvement of the oil companies' chemical business has served to run up profits from chemicals as a per cent of total profits. For the third quarter of 1979, chemical profits made up 10.2% of total earnings for the five oil producers. In the third quarter of 1978, chemical profits were a more modest 8.5% of total oil company profits. The increase is even more dramatic for the first nine months of this year, when chemical earnings were 11.3% of the total. Chemical earnings in the same period of 1978 made up just 7.3% of the five oil companies' total earnings.

Chemical operations at the oil companies also are outperforming earnings at the traditional chemical companies. While chemical earnings at the oil companies were more than doubling, earnings among 15 top chemical companies were increasing about 25% in the third quarter on a sales increase of 26%. Thus, the average profit margin for these chemical firms was 5.9%, the same as it had been in the third quarter of 1978. For the first nine months of 1979, the 15 chemical companies increased earnings a little more than they did in the third quarter, with an average increase of 27.8% over the first nine months of 1978.

The 25% earnings increase among the 15 chemical companies, though

Chemical earnings at oil firms skyrocket 127% . . .

	THIRD QUARTER					FIRST NINE MONTHS				
	Chemical earnings		%	Chemical earnings as % of total earnings		Chemical earnings		%	Chemical earnings as % of total earnings	
$ Millions	1979	1978	change	1979	1978	1979	1978	change	1979	1978
Exxon	$103.0	$66.0	56.1%	7.1%	12.3%	$320	$189	69.0%	10.9%	10.0%
Gulf Oil	82	16	412	19.7	7.6	196	52	276	20.5	10.0
Standard Oil (Ind.)	57.8	11.1	421	13.3	3.8	150.6	49.4	205	12.7	5.7
Mobil Oil	36.0	23.0	56.5	6.1	8.9	95.0	55.0	72.7	6.6	6.9
Conoco	20.7	15.9	30.2	8.4	15.0	78.0	41.8	86.6	12.5	14.1
TOTAL	$299.5	$132.0	126.9%	10.2%	8.5%	$839.6	$387.2	116.8%	11.3%	7.3%

. . . far outshining big 25% earnings rise for chemical companies

	THIRD-QUARTER 1979						FIRST NINE MONTHS 1979					
		Change from		Change from	After-tax income as % of sales			Change from		Change from	After-tax income as % of sales	
$ Millions	Sales	1978	Earnings[a]	1978	1979	1978	Sales	1978	Earnings[a]	1978	1979	1978
Du Pont	$3,133.2	17.9%	$234.0	13.9%	7.5%	7.8%	$9,395.3	18.9%	$707.7	26.5%	7.5%	7.1%
Dow Chemical	2,426.4	44.9	198.4	29.3	8.2	9.2	6,808.1	34.3	589.6	35.0	8.7	8.6
Union Carbide	2,325.7	14.5	138.6	71.7	6.0	4.1	6,780.2	17.3	413.7	55.3	6.1	4.6
Monsanto	1,496.7	26.1	82.1	75.4	5.5	3.9	4,647.3	25.1	303.4	17.3	6.5	7.0
W. R. Grace	1,278.6	22.4	57.3	42.5	4.5	3.8	3,781.1	17.5	153.3	17.4	4.1	4.1
Allied Chemical	1,250.6	70	19.2	−42.9	1.5	4.6	3,034.1	35.6	108.2	−4.7	3.6	5.1
American Cyanamid	782.0	14.8	35.7	−1.0	4.6	5.3	2,330.0	14.2	119.6	6.8	5.1	5.5
Celanese	778.0	20	37.0	12	4.8	5.1	2,332.0	21	114.0	48	4.9	4.0
Diamond Shamrock[b]	606.0	32.3	37.1	25	5.3	6.5	1,700	30.8	119.6	29	7.0	7.2
Hercules	605.0	23	41.4	28.2	6.8	6.6	1,749.0	22	117.7	49.9	6.7	5.5
National Distillers	491.0	10.8	26.2	6.9	5.3	5.5	1,600	23.1	88.8	16.7	5.6	5.7
Ethyl Corp.	442.0	23	28.0	21.0	6.3	6.5	1,225.9	78.0	75.5	14.9	6.2	6.3
Olin	428.1	10.0	10.8	−41.0	2.5	4.7	1,337.1	16.1	55.6	15.6	4.2	4.2
Rohm & Haas	391.9	30.2	26.2	88.5	6.7	4.6	1,202.7	27.3	72.5	82.7	6.4	4.7
Stauffer Chemical	312.5	15.7	11.0	−33.3	5.0	6.1	1,156.4	15.2	95.9	4.0	8.3	9.2
TOTAL	$16,747.7	26.0%	$983.0	24.8%	5.9%	5.9%	$49,079.2	21.8%	$3135.1	27.8%	6.4%	6.1%

a After-tax, before extraordinary or nonrecurring items. b Includes extraordinaires.

large, may be the first indication that earnings gains for the chemical companies reached their peak in the second quarter. At that time, earnings for the top 20 chemical companies, from which this sample of 15 companies is gathered, climbed 33% over the previous year's second quarter (C&EN, Aug. 13, page 8). □

Study shows few health effects from dioxin

A mortality study of the 121 Monsanto workers believed to have been exposed to tetrachlorodibenzo-*p*-dioxin (TCDD) in an industrial accident 30 years ago has found surprisingly few long-term health effects.

The study finds no apparent excess of deaths in these workers from either cancer or cardiovascular disease. And the 32 total number of deaths so far among the workers is less than would be expected from the national average.

The study, which has been accepted for publication later this year in the *Journal of Occupational Medicine*, was conducted by Monsanto epidemiologist Judith A. Zack and by Raymond R. Suskind, director of the Institute of Environmental Health at the University of Cincinnati Medical Center.

Monsanto says the study covers all 121 of the workers from the company's Nitro, W.Va., 2,4,5-T plant who developed a skin condition called chloracne after an explosion at the plant in 1949. Chloracne is a skin eruption that is closely associated with exposure to certain chlorinated organic compounds, including TCDD. Some toxicologists, such as Richard J. Kociba of Dow Chemical, argue that it is the most sensitive short-term indication of dioxin exposure in humans.

The accident at Nitro was the earliest recorded incident of dioxin exposure involving a population of this size. Thus, this comprehensive followup, the authors say, represents the best opportunity so far to study the long-term effects of dioxin on mortality. All 121 people were traced through plant medical records, workmen's compensation files, and, where applicable, official death certificates.

The Monsanto study adds weight to the supposition of some toxicologists that TCDD, although extremely toxic to several types of animals, may be much less so to humans. This view has been based primarily on data available from an industrial accident that released TCDD over a portion of the town of Seveso, Italy, in 1976. There, about 700 people were temporarily evacuated from their homes as a result of the accident, and eventually more than 100 cases of chloracne were reported, mostly among children. So far, however, no human deaths have been directly attributed to TCDD exposure.

The Monsanto mortality study is only the first part of a larger analysis, based on mortality data as well as health information gathered last June in examinations of more than 400 present and former Nitro plant employees, Monsanto says. This study will include both workers exposed in the 1949 accident and workers, not exposed at that time, who worked in the 2,4,5-T operation between startup in 1948 and 1969 when Monsanto stopped making 2,4,5-T. These workers will be compared with a control group of employees from other areas of the plant. □

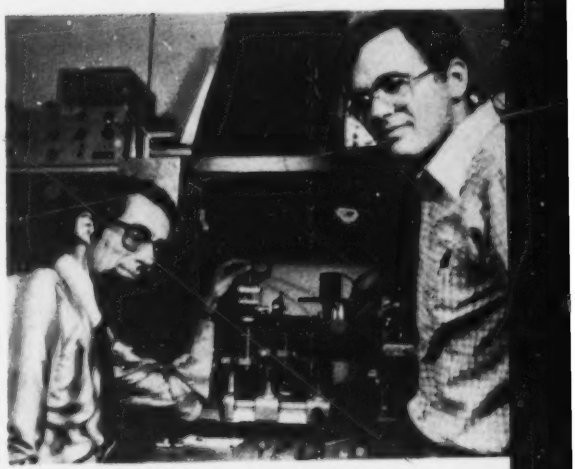
IBM develops laser electroplating method

Research scientists at International Business Machines' Yorktown Heights, N.Y., facility have developed an experimental electroplating technique that uses a laser to enhance metal deposition over small areas. The technique could lead to a simpler way of producing the small metal patterns in electronic circuitry, doing away with need for the overlaid "masks" that are used in fabricating conventional photolithographic circuits.

With the new technique, a finely focused laser beam heats up a small surface area on which metallic material is to be deposited and enhances deposition of the metal, IBM's Robert J. von Gutfeld told the semiannual meeting of the Electrochemical Society in Los Angeles. The technique was developed by von Gutfeld and Robert L. Melcher, with additional contributions from Lubomyr Romankiw, Samuel E. Blum, and Eugene E. Tynan.

Cathodes used in IBM's experiments were of tungsten, molybdenum, or nickel, in layers about 0.1 micrometer thick, predeposited on glass substrates. Anodes can be of platinum and chemically inactive in the plating process, or of the metal being deposited, the IBM scientists point out.

The lasers employed were continuous-wave argon (1.5 watt output power) or krypton (about 0.1 watt), with a mechanical light chopper to supply millisecond optical pulses when desired. A plating voltage of about 1.5 volts was used with plating solutions of dissolved salts of gold, nickel, or copper.



IBM's von Gutfeld and Melcher with their experimental electroplating system

As one example of the technique's use, 600 to 1000 times as much nickel was deposited on areas of tungsten irradiated by the laser as was deposited on the nonirradiated regions. Incident optical power was about 5000 watts per sq cm.

Using the technique, the IBM researchers have been able to electroplate areas as small as 4 micrometers in diameter.

The IBM scientists have evolved a conceptual model for the laser-enhanced plating effect. It arises, they believe, from sharply defined thermal gradients produced by the laser beam. The absolute change in temperature is only about 50° C for an incident beam of 500 milliwatts and 300 micrometers in diameter, they explain. But the change occurs over such a small distance that it produces intense convective effects. According to the model, the laser-induced convection causes the layer of solution next to the cathode to move from the cathode, thus promoting the inflow of new, ion-rich solution. □

Sunbelt gets new analytical meeting

Analytical instrument conferences and exhibits have tended to concentrate in the Northeast and Midwest. Now the Sunbelt is getting one, too.

Expochem 79, with the date to be changed to fit the year, kicked off last week in Houston with a four-day program. According to Albert Zlatkis, chairman of the organizing committee for the international exposition, it will become an annual meeting to serve the large academic, industrial, and biomedical analysis community of the Gulf Coast region.

Outlook for organic solvents remains bleak

Growth in demand continues to be slack because of high costs of raw materials and environmental problems in solvent use and disposal

Organic solvents of all kinds—and the U.S. solvents industry as a whole—are getting an ever-more-tarnished business image as the 1970's draw to a close. The heady days of high growth rates for investment and production appear to be over, despite some vigorous attempts at renewal in recent years.

For a variety of reasons, production growth in the next few years for these materials will be low, mostly from 0 to 3% per year, with some declines possible. The spreading U.S. recession won't help, nor the relentless increase in cost of raw material hydrocarbons.

But, more fundamentally, organic solvents will continue to suffer from a boomerang effect of their most useful property, dissolving power. Powerful solvents can conveniently carry a host of other organics such as paint to desired uses. Other solvents can just as conveniently carry unwanted oil, dirt, and other substances away from use areas.

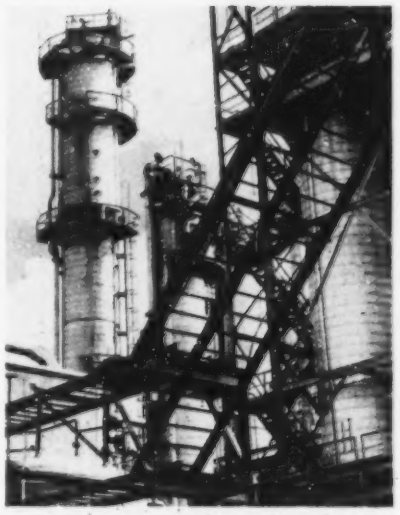
But then the trouble starts. Since solvents are carriers, they must eventually be disposed of once their usefulness is ended. If disposal cannot be strictly controlled, the solvents are vented to the workplace or the atmosphere. There, they become pollutants and possibly worse.

For more than a decade, a governmental crackdown on solvent emissions and inconclusive testing on the toxicity of these emissions has curbed organic solvent use. At the same time, development of competing solvent materials, notably plain water, or of solventless product delivery has hurt future growth for the organics.

In the end, some compounds known traditionally as solvents may grow more in the future in nonsolvent uses. That's already true for acetone, a strong solvent whose main use now is as a raw material for methyl methacrylate. Ethanol's chief growth chance now is as a fuel in combination with gasoline. Methylene chloride has pinned much hope on growth as a propellent in aerosols.

For the 1970's, organic solvents came out in something of a draw. Gains in some compensated for steep declines in others. For the six leading oxygenated and chlorinated hydrocarbons used mainly as solvents, U.S. merchant sales volume this year will be just about what it was in 1969 at 3.4 billion lb. These compounds are ethanol, methyl ethyl ketone, perchloroethylene, methylene chloride, 1,1,1-trichloroethane, and trichloroethylene.

Because of hugely inflated raw material hydrocarbon costs, merchant market value for these solvents will be much more than 10 years ago, about $785 million in 1979 compared to the $254 million in 1969 measured by the International Trade Commission. Average value per pound will have almost tripled in 1979, to 23 cents from 8 cents in 1969.



Union Carbide's Texas City, Tex., ethanol plant is one of world's largest

The big increase in market value for these solvents is some compensation for producers amid the ups and downs in specific products. Solvents are an overwhelmingly merchant business, with less than 15% of production for the six major oxygenated and chlorinated compounds used captively. That's been true for the past decade.

Since solvents have such high merchant exposure, market growth is especially important. Big investment has been committed in the past few years to increase markets.

The latest, and possibly saddest

Major U.S. solvents had low average annual production growth rates over past decade

Millions of lb unless otherwise noted	1979	1978	1977	1976	1975	1974	1973	1972	1971	1970	1969	% average annual growth, 1969–79
CHLORINATED												
Perchloroethylene	670	722	664	669	679	734	706	734	705	707	635	0.5%
Methylene chloride	625	567	478	538	497	608	520	471	401	402	366	5.5
1,1,1-Trichloroethane	600	623	635	631	459	592	548	441	375	366	324	6.4
Trichloroethylene	240	301	298	316	293	385	452	427	515	611	597	−8.7
OXYGENATED												
Acetone (billions of lb)	2.48	2.11	2.22	1.92	1.64	1.98	1.99	1.74	1.54	1.62	1.52	5.0
Ethanol (millions of gal)	196	190	194	224	209	239	299	264	239	299	358	−5.8
Methyl ethyl ketone	569	598	512	524	425	506	541	509	484	480	484	1.6

Sources: International Trade Commission, industry estimates

case, is 1,1,1-trichloroethane—whose immediate market prospects, together with ethanol's, is given on the following pages. Hopes ran high for 1,1,1-trichloroethane five years ago as the compound seemed to capture markets lost by trichloroethylene and perchloroethylene. By 1976, 1,1,1-trichloroethane nearly doubled in production from 1969 to 631 million lb.

Then all three 1,1,1-trichloroethane producers—Dow Chemical, PPG Industries, and Vulcan Materials—sank money into new production units. These expansions came on stream in 1978 and 1979, nearly doubling industry capacity to 1.29 billion lb by first-quarter 1980.

Unfortunately, 1,1,1-trichloroethane's market went flat just as these plants were being constructed. Production this year will be less than in 1976, even with a boost from exports. Market growth, by capture or any other means, simply didn't materialize. This leaves producers with the unhappy prospect of plant use running 50% for the next year.

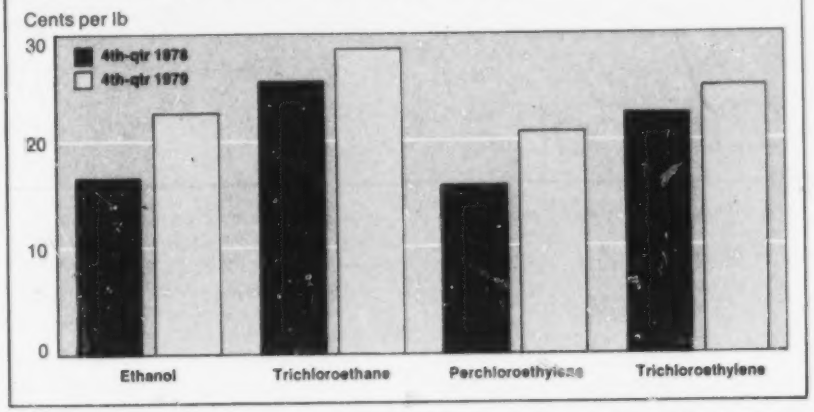
For other solvents, the 1970's haven't brought such shocking market turns. But the results haven't been encouraging either. Both perchloroethylene and trichloroethylene, the two traditional top chlorinated solvents, will finish the 1970's with less production then at the start of the decade. Both have been hurt by solvent emission controls, especially for trichloroethylene, whose market has dropped by more than half.

In oxygenated solvents, ethanol has suffered the same volume fate as trichloroethylene, but for a different reason. Ethanol lost a billion pound, largely captive market when acetaldehyde producers switched starting material from ethanol to ethylene. Ethanol's merchant shipments fell only 8% from 1969 through 1979, because solvent uses nearly held up. Solvent use of ethanol will continue to show no growth or a slight decline in coming years, producers expect.

For the present, chlorinated solvents are in a year of no overall growth. In 1978, production of the three most important two-carbon chlorinated solvents totaled about 1.65 billion lb. This might not be exceeded in 1979, if estimates of production thus far are extrapolated to an annual basis. More likely, production in 1979 will be off a bit to around 1.5 billion lb for these three.

The other commercially important chlorinated solvents are derivatives of methane. Some of these—methyl chloride (made either from methane or methanol), methylene chloride, chloroform, and carbon tetrachloride—find many more diverse non-

Prices of major solvents are up strongly



solvent uses than do the C_2 chlorinated hydrocarbons.

Production of chlorinated methanes in 1978 totaled about 2.1 billion lb. Production in 1979 should about equal this based on production thus far.

In the oxygenated solvents, 1979 is turning up slightly for synthetic ethanol but is falling to date for methyl ethyl ketone.

Aromatic and aliphatic hydrocarbons used as solvents fluctuate with competing gasoline demand. These products run the gamut of single compounds of high purity to mixtures whose composition varies because physical properties such as boiling point are used as specifications. The solvent uses of these hydrocarbons are relatively small compared to total consumption, largely in fuel. Most of these products are in the gaso...e boiling range among distillates in refineries.

For aliphatic and aromatic hydrocarbons to be used as solvents, consumers must pay enough to match these hydrocarbon's value in competing uses, usually in some kind of fuel, plus the cost of separating and purifying them. Until the most recent round of crude oil price increases, price changes of many of these solvents were usually small but frequent, reflecting market conditions for gasoline.

In contrast, prices for oxygenated solvents produced in chemical plants have not changed so often, but had bigger changes in prices when they came, reflecting the differences in marketing of chemicals and fuels.

In chlorinated and oxygenated solvents, exports are going to be an important plus this year, as they have been for most chemicals. In Commerce Department figures, exports for the first half of 1979 were almost as much as full-year 1978 totals for the leading compounds—72% of 1978 exports for perchloroethylene, 94% for methylene chloride, 75% for 1,1,1-trichloroethane, 91% for trichloroethylene, 64% for ethanol, and 94% for methyl ethyl ketone. Exports are particularly important to trichloroethylene and, if they continue as in the first half, will account for about one fourth of full-year 1979 U.S. production.

The robust state of solvent exports, ironically, puts even more caution into forecasts for 1980. Even with these exports, solvents are having a generally no-growth year in 1979 U.S. production. If other economies begin to grow more slowly in 1980 or 1981, or if the raw material cost advantage enjoyed by the U.S. begins to decline, exports may not pack as much punch a year from now.

William F. Fallwell and William J. Storck, C&EN New York; Bruce F. Greek, C&EN Houston

Organic solvents—four main classes

The U.S. organic solvents business is hard to pin down in its entirety because of the large number of compounds that find some use for their dissolving properties, even though they are not usually thought of as solvents.

Although in practice the word "solvents" is narrowed to mean the well-known oxygenated and chlorinated chemicals such as ethanol and perchloroethylene, the overall solvents business encompasses two other classes. These are aliphatic and aromatic hydrocarbons without oxygen or chlorine.

The aliphatics are mostly light petroleum distillates from oil refineries such as the mineral spirits used to thin alkyd paints. The aromatics are standard benzene, toluene, and xylene, which find a small part of their use as solvents. These, too, are largely products of the oil industry.

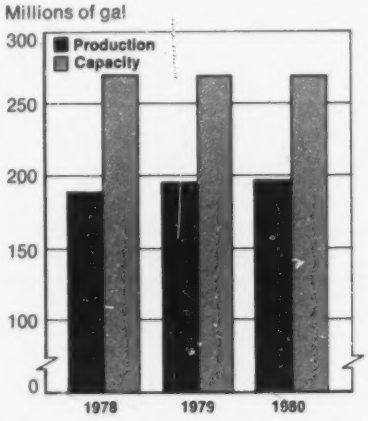
Key Chemicals

CH_3CH_2OH

Ethanol

- ***Demand slow***
- ***Capacity flat***
- ***Prices rising***

PRODUCTION/CAPACITY



HOW MADE

Direct hydration of ethylene

MAJOR END USES

Solvents 55%, chemical intermediates 35%, food processing 7%

FOREIGN TRADE

Exports—rising to 9 million gal in 1979; Imports—falling somewhat to about 19 million gal

PRICES

$1.53 per gal for 190-proof ethanol; $1.65 per gal for anhydrous

COMMERCIAL VALUE

$266 million for total production, 1979

Ethanol, which is much in the news lately as a result of its use in gasohol, would seem to have a lot going for it and, in general, it does. But synthetic ethanol, that which is made by the hydration of ethylene, is still languishing.

The apparent contradiction is caused by the structure of government energy programs. For ethanol to qualify for excise tax breaks, it must be made from renewable resources. This means that only ethanol made by fermentation can qualify.

Thus, synthetic ethanol receives little help from gasoline conservation programs. The only bright spot, and it is small, is that some fermentation alcohol that previously had been sold to the industrial market has been shifted to gasohol production, leaving the entire industrial area to synthetic. Fermentation alcohol in the industrial market has never been more than a few percent of synthetic production.

Ethanol producers thus expect a small surge in demand this year to make up for the fermentation alcohol that has been shifted out of the industrial marketplace. They expect that production will increase to about 196 million gal this year, about 3 to 5% higher than 1978, with most bets on the 3% side.

Demand for ethanol, however, is going to have to pick up greatly through the remainder of the year if producers are to meet their targets. Production of synthetic ethanol through August was 127.7 million gal, down 5% from the first eight months of 1978, according to figures from the International Trade Commission. The August figures are the latest available.

However, even a 3% rise is not much considering that, through 1978, production of synthetic ethanol fell an average of 5% per year during the past decade. For the past five years, the decline has been precipitous—more than 8% per year.

Ethanol makers believe the situation next year will be anybody's guess. They say the slowdown in the U.S. economy is already being felt in ethanol demand. If production does increase in 1980, it will be no more than 1% above 1979. And some say that production will fall next year.

As a consequence of the lack of growth in ethanol demand, production capacity has been static for some time and will remain at 270 million gal for the foreseeable future, according to producers.

Ethanol's capacity use has fallen for several years, to about 70% in 1978. It may rise to about 73% for all of 1979, and will be at best about 74% for 1980.

One factor keeping capacity use down and depressing demand for domestic U.S. ethanol is imports. In 1978, imports of ethanol for industrial purposes totaled 22 million gal, mostly from the U.K., and, in fact, mostly from British Petroleum. Producers say that BP has made a conscious effort to gain part of the U.S. market. This 22 million gal of ethanol was equal to about 12% of domestic production.

This year imports may fall somewhat, but they are expected to be at least 19 million gal. This would be a little less than 10% of domestic production. Exports, by contrast, will be no more than 9 million gal in 1979.

In spite of ethanol's low capacity use and significant imports, producers have had little or no trouble maintaining price increases. However, these increases have been mostly cost passthroughs. The latest increase occurred on Oct. 1, when the price of 190-proof ethanol rose 8.5% to $1.53 per gal. Anhydrous ethanol, which amounts to about 40% of U.S. production and is used as a chemical intermediate where the presence of water would be detrimental, is 12 cents a gal higher. The price spread between 190 proof and anhydrous ethanol has increased since the beginning of the year. At that time, there was only a 10 cent-per-gal difference between the two.

The present base price of $1.53 per gal is 29% higher than $1.185 on Jan. 1 of this year. The anhydrous price is 28% more than it was at the beginning of the year. Producers think that they will be able to continue to pass through increased production and distribution costs to their customers, but will get no further increase for profits.

Lacking a single area of good growth, ethanol will continue to have relatively low capacity use. With 25% and more of idle capacity haunting the industry, producers will be hard put to increase profit margins on their sales.

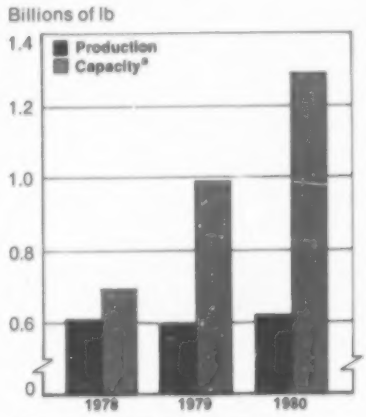
Key Chemicals

Cl_3CCH_3

1,1,1-Trichloroethane

- ***Demand growth slow***
- ***Capacity bulging***
- ***Prices catching up***

PRODUCTION/CAPACITY



a Nameplate capacity as of first quarter.

HOW MADE

Chlorination of ethane; hydrochlorination of vinyl chloride or vinylidene chloride made from ethylene dichloride

MAJCR END USES

Metal cleaning 70%, solvents for adhesives, coatings, inks, and the like 20%, aerosols 5%

FOREIGN TRADE

Exports—less than 10% of production; imports—negligible

PRICES

$3.15 per gal directly to consumers; price discounted to distributors

COMMERCIAL VALUE

$150 million for estimated production, 1979

The up-and-coming member of the chlorinated solvents' family has stumbled. Because of its favorable physical properties, 1,1,1-trichloroethane had production growth rates until last year in the 7 to 10%-per-year range, well above rates for most other chlorinated solvents. However, estimates of 1978 and 1979 production and forecasts for 1980 production of this solvent reduce growth rates to 3% or less. At the same time, much new production capacity has come on stream at the three U.S. producers—Dow Chemical, PPG Industries, and Vulcan Materials.

Specifically, production of 1,1,1-trichloroethane in 1979 will be lucky to top 600 million lb. A production forecast of 625 million lb, equal to 1978 production, from some market sources might be too optimistic. Forecast production of 625 million lb in 1980, taking into account effects of a U.S. recession, could also prove optimistic.

Yet, nameplate capacity grew by 300 million lb in 1978 and about the same in 1979, to bring operating capacity to about 1.3 billion lb as 1980 begins. This means U.S. producers will operate at only 50% of nameplate capacity during 1980 to meet even an optimistic demand level.

Two years ago, the picture for 1,1,1-trichloroethane capacity use was much better. As 1978 opened, capacity was under 700 million lb. Production that year was about 625 million lb. Assuming that the large new capacity in 1978 produced a third of its nameplate maximum during the year, producers had an average plant operating rate of over 75%.

In 1979, capacity use for 1,1,1-trichloroethane plummeted. If production only comes to 600 million lb, and if 200 million lb a year of the new nameplate capacity is used during 1979, the use rate falls to nearly 50% of nameplate. Some production problems have been experienced during 1979, so individual company rates could be higher.

The result, obviously, is that no more capacity expansions will occur for 1,1,1-trichloroethane for some time. Meanwhile, efforts are under way in producers' laboratories to expand present uses of the material and to find large-volume new uses. Success has eluded developers so far.

Most of the development work has been to reformulate adhesives and coatings which use solvents, with the aim of using 1,1,1-trichloroethane in place of hydrocarbon solvents. This chlorinated organic is considered nonflammable and apparently has little effect on the environment, in contrast to many other hydrocarbon solvents.

However, gains for 1,1,1-trichloroethane at the expense of other solvents, such as aromatics, so far have been small, at least in adhesives and coatings. Gains in other end uses were large for a while and led to growth forecasts which, because of environmental problems of the other major chlorinated C_2 compounds, notably perchloroethylene and trichloroethylene, proved to be overly optimistic.

In the early 1970's, 1,1,1-trichloroethane replaced some trichloroethylene as a metal-cleaning and degreasing material. Much of this resulted from governmental attacks on trichloroethylene as a contributor to smog and as a possible carcinogen. In locations where smog is a problem, requirements for vapor emission controls took effect more than 10 years ago. Because of the high cost of control systems, metal-cleaning operators turned to 1,1,1-trichloroethane, whose basic price is higher, as a less expensive way to meet control standards.

In locations where smog hasn't been a problem, the change from trichloroethylene has been slow. Minor switches to 1,1,1-trichloroethane sometimes occur as new information appears on studies of potential carcinogenesis. On the whole, 1,1,1-trichloroethane is still a long way from replacing trichloroethylene.

Cleaning with 1,1,1-trichloroethane tends more toward sophisticated uses in contrast with other chlorinated hydrocarbons. In recent years, this material has gotten the nod for such specialized areas as electrical equipment and aerospace components.

These uses, while robust, are not growing as they had in the past, nor are more conventional uses in the machined-products category. As a result, 1,1,1-trichloroethane will get little production expansion over the next year as long as U.S. manufacturing growth remains stalled.